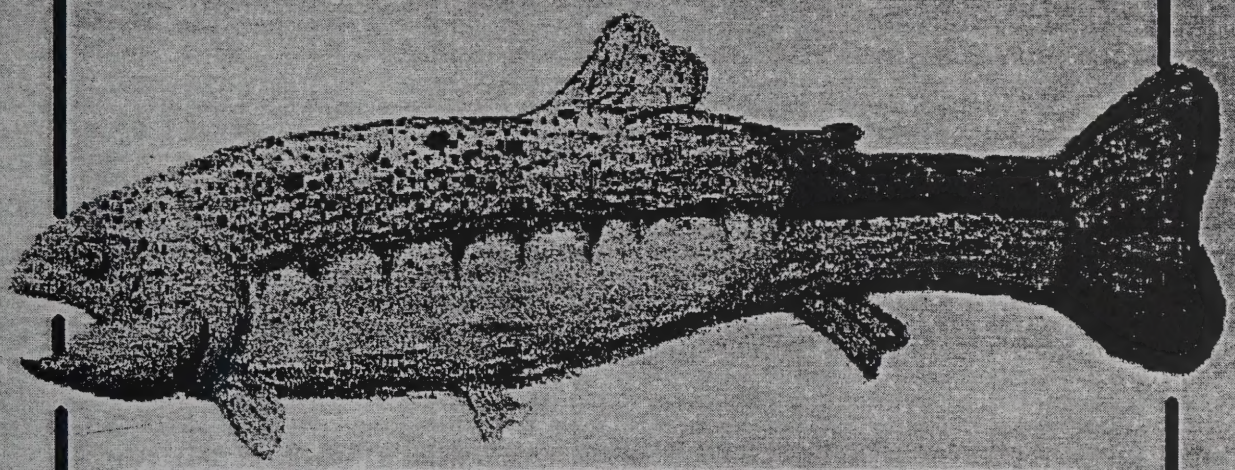
FINAL REPORT



Montana Whirling Disease Task Force

June 1996

FINAL REPORT
and Action Recommendations

Montana Whirling Disease Task Force

June, 1996

P.O. Box 6517
Helena, MT 59604
406-449-2196

This report was prepared by Policy Resources, Inc. under the direction of the Whirling Disease Task Force. Cover design: picture of whirling disease infected trout by Lawrence Riitano, a sophomore at Victor High School, Victor, Montana; additional cover art courtesy of the Helena *Independent Record.*

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Table of Contents

Table of Contents

Executive Summary

Since its discovery late in 1994, a remarkable amount of energy has been focused on whirling disease in Montana. Field researchers have tested approximately 100 sites around the state to obtain a clearer picture of the distribution of the disease across Montana's waterways. Preliminary field experiments have been conducted to assess the impacts of the disease on wild trout populations. The major scientific literature on the disease has been compiled, reprinted and distributed to researchers and other interested groups and individuals. Surveys have been conducted to assess the impacts of the disease on catch rates experienced by the angling public.

Unfortunately, many of these efforts have confirmed much of what was initially feared about the disease. Based on the available evidence, it is the consensus of the members of Governor Racicot's Whirling Disease Task Force that whirling disease is currently the most significant threat to wild, native and nonnative naturally reproducing trout populations in Montana. Whirling disease is also considered by the Task Force to be a significant threat to the Montana state, federal, tribal and private hatchery systems.

Whirling disease is caused by a microscopic, water-borne parasite that attacks the cartilage of young trout. Whirling disease spores (*Myxobolus cerebralis*) are released into the water when infected fish die and decompose, or when they are consumed and excreted by predators or scavengers. While the parasite may not directly kill a trout, an infected fish's erratic tail chasing makes it extremely vulnerable to predation. The disease also makes feeding difficult for infected fish, which can eventually result in starvation and death.

Why does whirling disease pose such a significant risk? First, while containment efforts are of the utmost importance, it is reasonable to expect that even with optimum safeguards in place, whirling disease will eventually spread to every major river basin in the state where both trout and the parasite's alternate host (*Tubifex* worms) are found. Given the wide range of potential vectors for the disease, the relevant question appears no longer to be if whirling disease will spread, but how long it will take to happen.

Second, although it is too early to make accurate predictions, it is clear that the potential long-term impacts could be very severe. Will whirling disease completely eradicate all wild trout from Montana streams? The current evidence suggests the answer is no. In the Madison, for example, adult rainbow trout populations in whirling disease-infected stretches have declined by more than 90 percent. But brown trout, while infected with the disease, have not shown population declines. And yearling rainbow trout numbers in 1995 were

actually higher than in the previous year. So even in heavily infected waters, it does not appear that whirling disease will eliminate all resident trout. Instead, a more serious threat is that the populations of fish that survive in whirling disease-infected streams will be so seriously depleted that they cannot sustain fishing pressure. Our wild trout populations may decline to the point where the Blue Ribbon fishing for which Montana is famous will no longer exist.

Is it hopeless? No. Encouraging avenues of research have been identified, and we believe that over time they are likely to yield workable solutions.

At present, however, the Task Force does consider whirling disease to be a very serious threat to Montana's trout fisheries. We urge the Governor, the legislature, and fellow citizens to recognize that whirling disease poses a very real threat to an important part of Montana's natural heritage. The threat is very real – to native species, to wild nonnative trout, and to recreational fishing for these species.

This Phase II Report is being distributed by the Task Force to provide background information to the Governor and other elected officials, as well as the Montana public, concerning whirling disease. The report summarizes the findings of the Task Force concerning the disease and sets forth nearly 40 different recommendations to address the whirling disease problem. To summarize the cornerstones of our recommendations:

The Task Force recommends as a guiding philosophy that all actions to address whirling disease be consistent with protecting, preserving and restoring self-sustaining populations of wild, native and nonnative trout. Montana is the only state in the contiguous 48 states that does virtually no stocking of its rivers and streams. Our trout streams have reached world-class stature by relying nearly exclusively on natural reproduction rather than hatcheries.

Research: We recommend an aggressive research program to facilitate the diagnosis and control of whirling disease, and to identify strains of wild and native trout that exhibit resistance to the disease. Research activities should follow parallel tracks – pursuing immediate research needs and longer-term construction and operation of a wild trout research facility in Montana. Recommendations include the following:

- Survey all major bodies of water with trout to determine if whirling disease is present, and if so, assess the severity of the infection.

- Determine which species of trout in Montana are susceptible to whirling disease and how populations of these fish will be affected.

- Conduct field studies to determine whether wild trout that survive whirling disease do so because of a particular behavioral trait (e.g. timing of spawning).

- Field sample for *T. tubifex* worms to enable mapping of their distribution in the state and develop technology to better distinguish between *T. tubifex* and similar worms, and characterize *M. cerebralis* infection in *T. tubifex.*

- Because the Task Force's current findings indicate that experimental research in a controlled laboratory environment is the only way to properly evaluate the degree of susceptibility of various fish species and any inheritable genetic trait that confers resistance to the disease, we believe that the construction and operation of a wild trout research facility in Montana is of great importance to the entire effort.

- Support immediate research needs in field studies of Madison River rainbow trout and Ruby River brown trout; quantitative experimental infection and disease dynamics in rainbow and brown trout; validation of PCR methodology for detection of infection in worms and fish; and similar current efforts.

- Further information on the scientific research which has been done on whirling disease, and updates on research which is now in progress, can be found on the Internet at the Whirling Disease Foundation's home page, at http://www.montana.edu/wwwwdr/.

Management: We recommend management decisions and policies that will nurture survivors and maintain native and wild trout populations, while recognizing the need to preserve our unexcelled recreational fisheries. Task Force recommendations include:

- Emphasize learning so more informed management decisions may be made.

- Conserve populations of wild trout that survive in whirling disease infected waters so that researchers can determine why they survive.

- Control the spread, and minimize the impacts of, whirling disease through education and regulation.

- Encourage all relevant regulatory agencies, as part of their permitting processes, to include mandatory decontamination of earthmoving equipment which is used in lakes or streams.

- Despite the current evidence that whirling disease is likely to result in reduced angling opportunities at least in some infected waters, the Task Force believes that stocking of catchable trout conflicts with the overall goal of protecting, preserving and restoring self-sustaining populations of wild salmonids.

Communication & Education: Management and research will prove useless if education is inadequate. Therefore, we recommend an ongoing communications effort to ensure that all Montanans fully understand the value of our wild trout fisheries . . . and how to help protect them.

- The communication of new management programs and new research data is essential.

- FWP should continue its practice of releasing new information to the public as it becomes available.

- Programs should be started to inform the public about the threat of whirling disease, how to avoid spreading it, and the value of wild trout.

The potential economic impacts of whirling disease in Montana are severe. Anglers come from across the nation – indeed from across the globe – to fish many Montana streams. It has been estimated that Montana's coldwater fisheries contribute over $250 million to the state's economy each year. While some communities which depend heavily on fishing would be severely impacted, such a large decline in revenues would also send shock waves throughout the Montana economy.

But the loss of trout is not simply a tourism or economic issue. Fishing for trout is also an important part of Montana's culture. Some 52 percent of all Montana residents purchase a fishing license each year. Add to that the number of young people who fish but do not need a license, and it becomes clear that the large majority of Montana citizens see fishing as an important recreational activity.

Task Force members are often asked "What can the public do to help?" and have sometimes expressed frustration that there seems to be little they can do other than watch and wait. However, there are some very important areas where the public *can* get involved. First, the Task Force urges all citizens to do everything in their power slow the spread of whirling disease. Everyone should know the recommended "do's and don'ts" when working or recreating in the state's waterways. A few simple precautions may help slow the spread of the disease, and that could buy time for critically needed research to be completed. Further

information about whirling disease, containment measures, and related issues can be obtained from the Task Force (406-449-2196), or through Montana Fish, Wildlife and Parks (406-444-3051) .

Second, the Task Force urges all concerned citizens to let their elected officials – at all levels of government -- know that whirling disease is a priority problem. The necessary research, management and communications activities will require a concerted effort by a state and federal agencies – people and financial resources. In an era of shrinking government budgets, it will be vitally important for the public to make their elected officials aware of the significance of this threat, and the need for an aggressive and effective governmental response.

Finally, the Task Force urges everyone who enjoys trout fishing in Montana to consider making a financial commitment to solving the problem. Tax dollars will help, but there is an important role for the private sector to play in this regard. Organizations such as the Whirling Disease Foundation, Trout Unlimited, and the Montana Whirling Disease Task Force rely on the financial support of the private sector to carry out their work. Information is provided below on how concerned businesses and citizens can make a tax deductible contribution to these organizations.

In summary, hanging in the balance is Montana's unique heritage of wild and native trout. A full frontal assault on this problem is urgently needed, bringing to bear the skills and resources of our citizens, scientists and public officials.

YOU CAN HELP. In the fight against whirling disease, the financial support of businesses and individual citizens is critically needed:

Contributions to the Montana Whirling Disease Task Force are tax deductible and should be made out to the Montana Community Foundation/Whirling Disease Task Force Fund, P.O. Box 6517, Helena MT 59604.

Contributions to Trout Unlimited in support of its whirling disease project can be sent to Coldwater Conservation Fund, Whirling Disease Project, c/o Trout Unlimited, 1500 Wilson Blvd., Suite 310, Arlington, VA 22209.

Contribution to support basic research on whirling disease can be sent to the Whirling Disease Foundation, P.O. Box 327, Bozeman, MT 59771.

Task Force Goals and Objectives

The Governor's Executive Order asks the Task Force to develop an *action plan* to address whirling disease. In order to accomplish this, the Task Force extensively discussed the guiding philosophy for such a plan, and a consensus was quickly reached:

> **Guiding Philosophy** – All actions to address whirling disease should be consistent with protecting, preserving and restoring self-sustaining populations of wild, native and nonnative salmonids.

This philosophical starting point deserves some additional explanation. Notice that the focus is on *wild* and *self-sustaining native and nonnative* fish populations. Many people do not realize or fully appreciate the fact that in the angling world, the state of Montana is unique. We are the only state in the contiguous forty-eight states that does virtually no stocking of its rivers and streams. Our trout streams have reached world-class stature by relying nearly exclusively on natural reproduction, and as a result anglers from all over the world make Montana a fishing destination to enjoy our state's wild trout resources. Anyone who has experienced a large Montana trout cartwheeling across the water and running for 40 yards understands the difference between hatchery fish and wild trout. It is the unanimous view of the Task Force that any actions which are undertaken to address whirling disease must be consistent with an overriding goal of maintaining and restoring our wild trout resources. Montana and wild trout are synonymous.

In particular, this means that hatchery stocking of streams is not an acceptable remedy for whirling disease-depleted rivers. Task Force members are frequently asked, "Well, couldn't we just stock more fish in the rivers to make up for the ones killed by whirling disease?" We believe the answer is an emphatic NO. Replacing wild trout with hatchery trout is – at least for the foreseeable future – an unacceptable option which would severely damage an important part of Montana's fishing heritage and its uniqueness as a fishing destination. And even if hatchery stocking *were* considered a viable option, as a practical matter the state does not have sufficient hatchery facilities to stock the state's major trout streams, and the costs of doing so would be prohibitive (Appendix 5 provides additional detail).

A second aspect of our guiding philosophy is the focus on <u>action</u>: *protecting, preserving* and *restoring* our trout populations. Another frequently-asked question is, "Well, why not just let whirling disease run its course – isn't it a natural phenomenon that Mother Nature will take care of?" The Task Force gave serious consideration to this option and unanimously concluded that immediate action is required. Montana's wild and native trout may over time

develop mechanisms to combat whirling disease; however, the value of our priceless natural heritage is too great to adopt a "wait and see" attitude.

Whirling disease is not native to the United States (it came from Europe), and in contrast to European trout, such as the German Brown trout, that evolved in the presence of whirling disease, our native trout species do not seem to have a natural resistance to the parasite. While it is possible that natural selection alone could eventually restore our fisheries to their previous population levels, there is no way of knowing how long this evolutionary process may take, and it is too early for evidence to suggest that any of our whirling disease-infected waters are rebounding. It could literally take thousands of years for our native trout species to adapt to whirling disease. Or it may simply be that in whirling disease-infected waters, much-reduced populations are the "natural" level ... and that without direct action, they will never rebound to their previous population levels. While nature may provide the final answer, we must develop the technology and knowledge necessary to recognize that natural resistance is emerging and to enhance natural restoration where appropriate.

All of this suggests to the Task Force that carefully considered action to protect and restore our trout populations is needed.

Strategic Approach

In its Interim Report, the Task Force suggested three objectives which need to be addressed concerning whirling disease: (1) support of basic research on whirling disease, (2) implementation of various containment measures to reduce the spread of the disease, and (3) mitigation of the impacts of whirling disease, both to trout populations and to the state's economy. The Interim Report also set out a series of recommendations for numerous short-term activities, based on the early information which was available on the disease. With very few exceptions, these short-term recommendations have been fully implemented (Appendix 4 provides a summary of the recommendations and their status).

In this Phase II Report, the Task Force has set out long-term recommendations that are consistent with these three broad objectives, and which are flexible enough to adapt as more is learned – to be responsive to changing conditions and to new data as it emerges.

Our overall strategy for dealing with whirling disease is predicated upon the assumption that getting rid of the infectious organism – the *Myxobolus cerebralis* parasite – is not possible.

At present, there is little which can be done to directly attack the parasite itself. Although we should not give up on the possibility that some mechanism may be found to attack *M. cerebralis*, to date no one has offered any suggestions for a strong research protocol to accomplish this. In an effort to eradicate whirling disease in the Fremont River, the state of Utah took the extreme approach of poisoning the river in three successive years to remove all fish. By eliminating the trout that serve as a host for the disease, they hoped to eliminate the disease itself. While the long-term success of this approach is not clear, it does not appear to be a feasible strategy for thousands of miles of Montana streams.

In all likelihood, therefore, this disease will keep spreading. There is no clear pattern to the distribution of the disease across the state, and much work remains to understand the key vectors for spreading the disease. At present, therefore, it appears that *a strategic "solution" to the problem will need to reduce the impacts of the disease, probably with the understanding that it is a disease which cannot be eliminated from our state's waters.*

We believe that the most promising avenue of research is to focus on one of the disease hosts – the fish (see Appendix 6 for a discussion of the life cycle of the disease). Fortunately, there *are* survivors in whirling disease-infected streams. Some survivors may never have been exposed to the disease, but others may have been exposed but either failed to become infected, or were infected and did not suffer fatal consequences from the disease. Thus, our best hope seems to be the possibility that some of the fish in infected streams enjoy some level of natural resistance to whirling disease. There have been some suggestions in various articles written about whirling disease that there may be some strains of rainbow (and other trout species) outside of Montana which are more resistant to whirling disease – but to date these are unverified.

The Task Force believes that identifying naturally resistant strains of trout which survive and reproduce in whirling disease-infected waters is currently the most promising long-term strategy for dealing with whirling disease and forms the basis for restoring wild and native trout populations. But within that general strategy there are some additional preferences and priorities. First, finding ways to support and enhance current survivors in whirling disease-infected streams is most desirable. To the extent that this does not present an adequate solution, stocking current stream populations with resistant strains from other Montana waters should then be evaluated. If no naturally resistant Montana strains are identified, then evaluation of resistant strains from other states/countries should be considered.

If this general strategy works and resistant strains can be found, their introduction into Montana waters will no doubt raise some important policy questions. It may be possible, for

example, to give increased emphasis to native versus nonnative species, or to shift the population balance between different nonnative species (i.e. brown trout and rainbow trout). The Task Force believes, however, that the initial emphasis should be on restoring Montana waters to their pre-whirling disease conditions, not altering their fish population characteristics. Until basic research is accomplished on the relative susceptibility of wild and native species, no decisions should be made concerning the shifting of population balances.

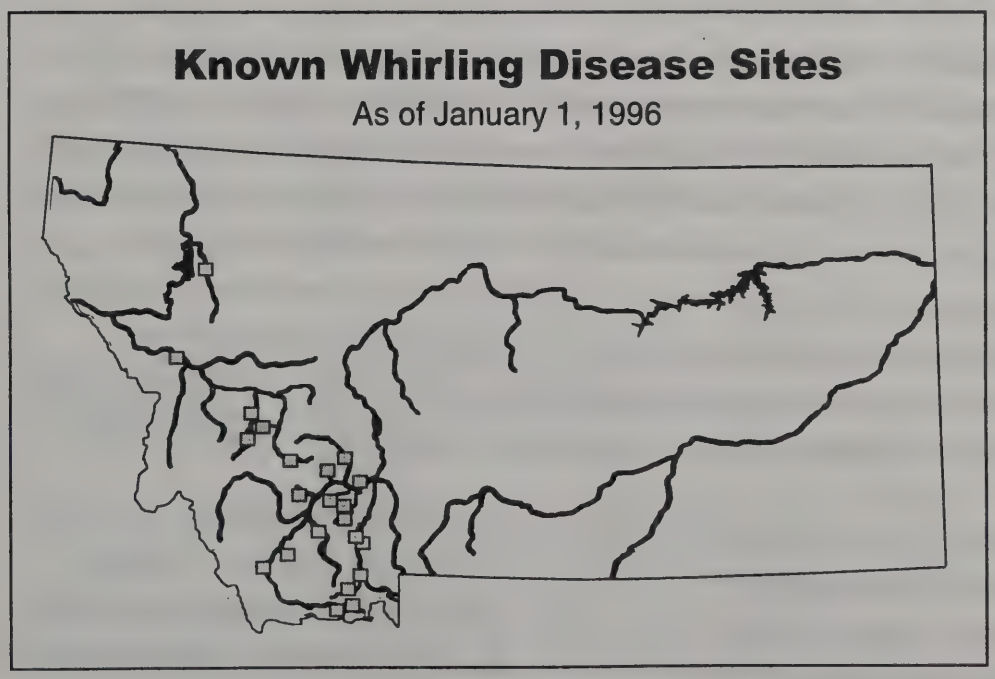
It should also be emphasized that while we do have hopes of finding naturally resistant strains, the Task Force does not believe this should be the sole avenue of scientific research. Given that we are at a very early stage of understanding the disease and its impacts in Montana, we should not foreclose any reasonable research strategy. This would certainly include research relating to the parasite and its alternate host, the *T. tubifex* worm.

The bottom line is that the whirling disease problem is just that – a problem. It is by no means a lost cause. While the potential threat is very real, the sky is not falling. Encouraging avenues of research have been identified, and we believe they are likely to yield workable solutions. In the meantime, anglers should be encouraged to enjoy our state's excellent fishing opportunities, but to take appropriate precautions to reduce the chance of inadvertently spreading the disease.

Findings

The following section summarizes some of the major findings which have been reported to the Task Force by Montana Fish, Wildlife and Parks and by other researchers who are working on this issue. These findings represent the factual underpinnings upon which many of our recommendations are based.

F1. Whirling disease is not just a Madison River problem. Whirling disease was first discovered in Montana in certain stretches of the Madison River. Field teams have since sampled approximately 100 locations statewide (and at least that many more will be sampled by the end of 1996). As of January 1, 1996 the whirling disease parasite has been confirmed in 21 bodies of water, on both sides of the Continental Divide, with the following sites known to be infected: the Madison River (from below Quake Lake to just below Ennis Dam); Blaine Spring Creek and O'Dell Creek (Madison River tributaries); Ruby Reservoir and Ruby River; Poindexter Slough (Beaverhead River drainage); Clark Canyon Reservoir, Red Rock Creek and a spring that feeds the Red Rock River; the Jefferson River, the Boulder River, Harrison Reservoir, Willow Creek, Hells Canyon Creek and Whitetail Creek (all in the Jefferson River drainage); the Clark Fork River (below Milltown Dam, near Missoula); Warm Springs Creek, Flint Creek, Racetrack Creek, and Stuart Mill Creek (all in the Clark Fork drainage); and the Swan River above Swan Lake.



While whirling disease is much more widespread than initially believed, two points should be emphasized. First, while some 21 water bodies have tested positive for the presence of the parasite, little is known about the impact of whirling disease on the trout populations at most of those sites. For most trout streams in the state, however, long-term trout population data are not available. At this point in time it is not possible to evaluate the actual impact of whirling disease on the trout populations in most positive test sites, simply because long-term trend data are not available.

Second, *many* important Montana fisheries have thus far tested negative for whirling disease. These include the Big Blackfoot (several sites); the Big Hole; Big Spring Creek in Lewistown; the Bitterroot River near Darby, Stevensville, Hamilton and Lolo; Blue Water Creek near Billings; Rock Creek near Missoula; Flathead River above Flathead Lake; Fort Peck Reservoir (for cisco, a forage fish); Gallatin River near Big Sky; Kootenai River above Kootenai Falls (rainbow trout); Madison River above Quake Lake; Missouri River near Townsend, below Holter and near Great Falls; Smith River; the Yellowstone River at Big Timber, Livingston and Corwin Springs; the Boulder River of the Yellowstone; and the Big Horn. At present, all Montana river basins are being monitored for the presence of whirling disease.

F2. Whirling disease is not just a problem for rainbow trout. The impact of whirling disease on rainbow trout has been extensively documented. Based on field research conducted over the 1995 summer, and reviews of the available literature, it is now apparent that whirling disease can also infect other species of salmonids.

In Montana, whirling disease has been found in rainbow, brown and brook trout. No infected cutthroat have been found in the wild, but Westslope cutthroat and Arctic grayling were infected in field experiments conducted on the Madison River during the summer of 1995. Mountain whitefish collected from the Clark Fork also appear to be infected with whirling disease, as do sculpins sampled from Poindexter Slough. However, some uncertainty remains as to whether the spores which have been found in sculpins are, in fact, *M. cerebralis*, due to differences in their size and shape compared to the spores found in whirling disease-infected trout. Genetic testing will be required to determine whether the spores in sculpin are the same as those in trout.

It appears, then, that most (if not all) species of salmonids can be infected by whirling disease. Important questions remain, however, concerning the impact of whirling disease on wild populations for many of those species. In some streams, such as the Madison River, brown trout populations have remained stable despite the presence of

the infection. In Colorado and possibly some streams in Montana, brown trout populations do appear to have declined as a result of the disease. And the population impacts on other species (cutthroat, bull trout, etc.) have not been scientifically investigated. These are important research issues which need to be addressed.

F3. There have been a number of anecdotal reports about strains of rainbow trout in other states either being unaffected by whirling disease or being resistant to other parasites similar to *M. cerebralis*. <u>However, to date there have been no systematic studies to evaluate natural resistance to whirling disease</u>. Testing for resistance and its genetic markers is a complex enterprise requiring controlled experiments in a laboratory setting. Even if a genetically resistant strain were identified in a laboratory situation, detailed field research would also be required to evaluate whether the resistance was also expressed to the same extent in the wild. While the existence of naturally occurring resistant strains remains an important hope, at this time it is only that.

F4. <u>Field research has given some preliminary indication that – under heavy fishing pressure – even catch and release fishing may have impacts on whirling disease-infected rainbow populations, and further testing is needed to validate these observations.</u> As part of the emergency regulations adopted for the Madison River during 1995, a 4-mile section of the river was closed to assess the impacts of fishing pressure in whirling disease-infected areas. Population counts were performed in a comparable catch-and-release section and in the closed section in both the spring and fall. In both sections rainbow trout populations declined over that time period (as would be expected even in uninfected streams). However, the decline was greater in the section open to catch-and-release fishing than in the closed section. This suggests that even catch-and-release fishing may have an impact on whirling disease-infected stream populations. However, these results are very preliminary and further testing is required before management implications can be reached.

F5. <u>Field research has demonstrated that the level of reproduction is not the source of the decline in rainbow trout populations in the Madison River.</u> Over the summer of 1995, Montana Fish, Wildlife and Parks (FWP) sampled 1200 feet of stream every two weeks, over an 8-mile stretch of the Madison River, monitoring the population of young-of-the-year (YOY) brown trout and rainbow trout. From June to November, rainbow trout YOY numbers dropped from 120 per 150 feet of stream to 18. Brown trout YOY estimates dropped from 40 fish per 150 feet of stream to 19. That is, initially rainbow trout were three times as abundant as browns, but by November their population levels

were equal to the brown trout level. This suggests that there are plenty of young fish to maintain a healthy wild trout population. However, 50 percent of the rainbow trout which were sampled showed clinical signs of whirling disease such as a sunken head, black tail, or bulging eyes (although very few actually whirled). Under the microscope, many fish also had histological evidence of severe disease. None of the brown trout which were sampled demonstrated clinical signs of the disease, however. How these YOY populations will change over the winter is unknown, but there is concern that infected rainbow trout will continue to suffer severe mortality. Monitoring will continue.

F6. Whirling disease can be highly infectious. In field experiments on Willow Creek, fish exposed to water known to be infected with *M. cerebralis* for as little as 10 days became heavily infected with whirling disease. Further research is needed to evaluate why these fish became so heavily infected, when fish in other field experiments (e.g. Blaine Spring Creek) sustained much lighter levels of infection.

F7. Although there is no known health risk to humans from whirling disease, humans can contribute to the spread of the disease. Whirling disease spores can live for long periods of time in dead fish and in mud, even after the mud fully dries. As a result, there is a possibility that whirling disease can be spread by anglers and other water recreationists. In its Interim Report, the Task Force suggested a series of "Do's and Don'ts" for anglers and other water recreationists which may help prevent the spread of whirling disease. This information is being posted at fishing access sites and distributed as "pocket cards" to individuals who buy fishing licenses throughout the state. The following is recommended:

- DO remove all mud and aquatic plants from vehicles, boats, trailers and axles, waders, boots and fishing gear before departing the fishing access site or boat dock.
- DO drain all water from boats and equipment – including coolers, buckets, and live wells – before departing the fishing access site or boat dock.
- DO dry your boat and equipment between river trips.
- DON'T transport live fish from one body of water to another.
- DON'T dispose of fish entrails, skeletal parts, or other by-products in any body of water or down kitchen drains or disposals.
- DON'T collect sculpin (also known as bullheads) or use sculpin, trout or whitefish as bait.

F8. Although the potential economic impacts from whirling disease are very significant, the impacts to date appear to have been relatively small. To date, most of the media attention which has been focused on whirling disease has spotlighted the Madison River. The Task Force has been concerned, therefore, about the potential impact of whirling disease on communities which are economically tied to recreational use of the Madison River (Ennis and West Yellowstone, in particular). Informal surveys of guides and outfitters on the Madison, and hotel operators in Ennis, suggest that some bookings were down during the summer of 1995, but this was not universally true. High water and rainy summer weather may have contributed to any decline in guided trips, as well.

In addition to these informal measures, FWP performed a creel census of Madison River anglers, which included several questions on whirling disease. Most people who fish the upper Madison (90%) are nonresidents, and some 25% are there on outfitted trips. Catch rates for rainbow trout on the upper Madison were down by about two-thirds when compared to the last creel census on the river, taken in 1981. Brown trout catch rates were up slightly. When asked if they perceived any problems on the Madison, most individuals reported either no problems or mentioned crowding as a problem. Only 6.5 percent of those surveyed mentioned whirling disease as a problem.

These results suggest that among anglers who fished the Madison during the summer of 1995, whirling disease was not perceived as a problem and did not affect their overall satisfaction with the angling on the river. These results do not, of course, provide any indication of perceptions among individuals who chose not to fish the Madison. A direct survey of residents and nonresidents who purchased a Montana fishing license is underway, and should provide further information about angler perceptions about the Madison and fishing in Montana. For the short-term, at least, the local impacts of the disease appear to have been relatively small.

F9. Other Montana streams may not be so lucky. Sections of several of our best wild fisheries enjoy rich populations of rainbow and/or cutthroat trout which may suffer major declines if and when the parasite becomes established. Examples include the upper Gallatin, the Missouri below Holter Dam, the upper Yellowstone, the Kootenai, and the Bitterroot Rivers. Ninety percent losses in these fisheries would clearly have tremendous negative economic impact in the state. Such a disaster has now been documented in Colorado, where several of the best wild fisheries have suffered such heavy losses that managers are adopting emergency measures to spawn the residual mature fish, raise fingerlings in clean hatcheries, and return these to the streams in the

hope of maintaining much of the gene pool of these strains until something better can be done. The numbers of catchable trout in some of these streams has fallen by more than 80 percent.

Nor can we be complacent about our salmonid natives. Red Rock Creek, home of the last indigenous adfluvial grayling stock in the lower 48 states, is heavily infected by whirling disease. And the recent discovery of the parasite in the Swan River, our best remaining spawning ground for bull trout, is cause for further concern.

Long-term Recommendations

Much has been learned about whirling disease, and for all that has been learned it seems that many more questions have been raised. Based on an overall objective of finding ways to reduce the impacts of the disease in Montana waters, the Task Force has developed a detailed action plan which addresses many aspects of the whirling disease problem. Specific recommendations have been organized around three focal points:

1. Scientific research needs;
2. Fisheries management policy; and
3. Communication and education.

The Task Force recognizes that a number of its recommendations have long time frames. We believe this is all the more reason why it is important to immediately begin the process of putting these recommendations into play.

1. Scientific Research Needs

The Science Subcommittee of the Task Force developed, and the Task Force adopted, several key goals for research on whirling disease. Core research questions were identified which form the basis for an overall research agenda. These were then broken down into more detailed research needs, each with specific action recommendations.

1.1. What is the scope of the whirling disease problem in Montana?

Further research is needed to determine the presence or absence of whirling disease in all major bodies of water with trout populations in the state; and at those sites where whirling disease-infected trout are found, an assessment is needed to determine the severity of infection.

Action Recommendations:

1.1.A. Continue sampling around the state to identify sites where there are infected fish.

1.1.B. When a site tests positive, initiate additional testing procedures to determine the severity of infection.

1.1.C. Complete the development of a polymerase chain reaction (PCR) assay as a diagnostic tool for detection of the whirling disease parasite in fish, worms and water supplies. Evaluate other nonlethal diagnostic tests, including enzyme-linked immunosorbent assay (ELISA).

1.1.D. Field test the assay to verify its utility in a field setting.

Because the *T. tubifex* worm is an alternate host for whirling disease, research is also needed to learn more about its distribution within various types of stream habitats. This will facilitate predictions as to where the disease is likely to spread, and what type of impact it may have. Unfortunately, there are very few individuals who can distinguish *T. tubifex* from similar aquatic worms.

Action Recommendations:

1.1.E. Field sampling for *T. tubifex* worms to enable mapping of their distribution in Montana.

1.1.F. Develop expertise and technology to better distinguish *T. tubifex* from similar oligochaete worms, and to characterize *M. cerebralis* infection in *T. tubifex.*

1.2. **Which Montana species are susceptible to the disease, and how will populations be impacted?** Most studies to date have focused on the impact of whirling disease on rainbow trout in a hatchery setting. Much remains unknown about the degree of susceptibility of various species, both in a laboratory setting and in the wild. Many questions also remain concerning the impact of the disease on whirling disease-susceptible populations. The Task Force recognizes the importance of both native and nonnative species in this regard. Specifically, research on the impacts of whirling disease on native species should be given equal priority to research on nonnative salmonids.

Action Recommendations:

1.2.A. Support laboratory research in a self-contained wild trout research facility to test species susceptibility under varying conditions (water temperature, spore load, etc.). Experimental research in a controlled laboratory setting is the only way to systematically evaluate the degree of susceptibility of various salmonid and nonsalmonid species to whirling disease.

1.2.B. Field research is also required to assess species susceptibility and disease impacts in the wild. While laboratory research may show that some species are susceptible, the impacts of whirling disease in the wild still need to be determined. Field work is needed to evaluate the impacts of the disease on different strains of fish in a wild setting, where many other variables such as life history, stream gradient, sediment load, habitat and water flows may enter the equation. Specific field activities are discussed below:

1.2.B.i. Expand live box testing at Willow Creek and the Madison River, focusing on seasonality, tissue damage and quantitative spore production for several fish strains and species.

1.2.B.ii. Expand the scope of field research activities: New sites should include the Yellowstone (uninfected); Madison/Pine Butte (infected, ongoing); Madison Norris (imminent infection); Upper Gallatin (high gradient stream); Missouri/Holter (major rainbow fishery); Clark Fork/ Milltown (tributary spawners) and the Big Hole River above Melrose. Study elements may include water temperature; general habitat characterization; young of year; annual fish population; seasonal worm density, speciation, infection; fish genetics.

1.2.B.iii. Initiate new field research sites on the Ruby River and/or upper Clark Fork focusing on brown trout.

1.2.B.iv. Dedicate additional new FTE's to whirling disease. Develop a FWP research position with support similar to the programs in Colorado and Idaho.

1.2.B.v. Obtain population data to determine impacts on streams other than the Madison River.

1.3. **Are some strains naturally resistant?** As discussed earlier in this report, the question of natural resistance is of critical importance. For those species which are determined to be susceptible to whirling disease, can some strains be identified which are resistant? It is possible that resistance may take at least two different forms. First, some species/strains may be *biologically* resistant. Research is needed to determine if some species/strains carry a genetic/immunological resistance to whirling disease, and if so, whether those resistant strains form the basis of a recovery strategy for infected waters. Second, some species/strains may exhibit important forms of *behavioral* resistance. In the wild, it is possible that such behavioral factors as timing of spawning; typical age of fish at time of exposure; and other variables could contribute a type of behavioral resistance to some strains of susceptible species. This possibility needs to be fully evaluated.

Action Recommendations:

1.3.A. Testing in a laboratory setting will be required to evaluate the possibility that some strains show a natural resistance to whirling disease which can be transmitted genetically.

1.3.B. The possibility of "behavioral resistance" will require field research to evaluate whether various behaviors (time of spawning, etc.) are related to varying degrees of resistance in whirling disease-susceptible fish.

1.4. **Are there solutions to whirling disease which focus on the intermediate host (*Tubifex* worms) rather than on trout?** Better understanding of the distribution of *T. tubifex*, its biologic requirements/habitat, and its life cycle is needed. This may lead to approaches for breaking the life cycle of whirling disease.

Action Recommendations:

1.4.A. Compare several common Montana oligochaetes for quantitative ability to become infected and produce the *Triactinomyxon* (TAM) form of the parasite.

1.4.B. Compare micro habitats and seasonal density of *T. tubifex* in infected and uninfected streams of both high and low gradient.

1.4.C. Compare the genetic characteristics of worms that, by external characteristics, are classified as *T. tubifex* in geographically and ecologically different watersheds. If differences are found, test these for infection and numbers of TAMs produced.

1.4.D. Develop in-state expertise within the University system in oligochaete ecology, particularly as it relates to whirling disease.

1.5. Final Research Recommendation: The Need for a Dual-Track Scientific Effort

Many of the research needs discussed above require experimentation in a controlled laboratory setting. Field research can answer many questions, but the core issues such as infection sensitivity/resistance, disease pathology, and spore biology cannot be addressed without controlled experimentation.

The Task Force strongly recommends a two-pronged approach to accomplish these research needs. First, a number of research proposals have been submitted to the Task Force for funding assistance, and many of these should be supported as quickly as possible, to the fullest extent possible. Second, the Task Force believes that it is critically important that a wild trout research facility be constructed and operated in the state of Montana. Each of these research tracks are discussed below.

1.5.A. **Construction of a Wild Trout Research Facility**. Because much of the necessary experimental research would utilize worms and fish that are infected with whirling disease, it is critically important that any laboratory facility be self-contained, with its own water supply and an acceptable method for handling water and biological waste materials which contain the whirling disease parasite. At present, no such facilities exist in the state of Montana.

The Task Force believes that construction and operation of a completely contained laboratory in Montana should be a top priority for addressing whirling disease. Construction of such a facility will require a capital investment that may exceed $1 million if new construction is necessary. Annual operation is estimated at about $250,000. Nevertheless, it seems clear that such a facility is the missing piece in the puzzle.

Montana Fish, Wildlife and Parks has unparalleled experience in, and documentation of, the ecology of our streams, and a vigorous program for monitoring and measuring fish populations, as well as providing materials for scientific analysis. The Bozeman Fish Technology Center has a first class histopathological capability, will shortly become manager of a federal fish diagnostic laboratory, and will soon have a contained facility where fish species and strains exotic to the Gallatin River watershed can safely be cultured for experimental studies.

The administrations of both the University of Montana and Montana State University have formally indicated interest in becoming involved in whirling

disease research. MSU has a group which has already commenced work on the DNA-based diagnostic assay developed by Professor Hedrick of the University of California-Davis and Beth MacConnell of the Fish Technology Center. MSU is also taking an active role in expanded ecological work through its FWS cooperative unit in the Department of Biology and has plans to add invertebrate biology to its staff. The U of M has world-recognized expertise in salmonid genetics and a parasitologist highly trained in invertebrate systems who has initiated studies on *T. tubifex* worms.

With all these resources in place, it is almost certain that a wild trout research facility associated with MSU and/or U of M could become a center of excellence devoted to work on wild trout. All the ingredients are here: a worldwide reputation for wild trout, the presence of whirling disease, broad interest and support from a public-private partnership, a federal fish technology center with scientific competence and a new facility to safely contain strains of fish (but not the parasite), and a history of progressive fish management.

Although there are a limited number of research facilities which could, in principle, take on the work identified by the Task Force, the reality is that there are far more research needs than existing facilities are capable of doing. A dedicated wild trout health lab would shorten the time frame for needed whirling disease research, and provide a buffer against the next wild trout health issue that emerges.

1.5.B. **Support of Immediate Research Needs.** Construction and operation of a wild trout research facility in Montana is a desirable long-term goal. At the same time there are immediate and specific research needs which need to be addressed. The Science Subcommittee has received, and the Task Force endorsed, several proposals for which we will be seeking immediate funding. These are:

1.5.B.i. *Quantitative experimental infection and disease dynamics in rainbow and brown trout:* R. P. Hedrick, UC-Davis and Beth MacConnell, Bozeman Fish Technology Center. One year, to set baselines of susceptible and resistant species, for future work in Montana and elsewhere. $175,000.

1.5.B.ii. *Live box supplementation of FWP-MSU Co-op Unit study of whirling disease on the Ruby River and Poindexter Slough, where brown trout are impacted:* Dr. Al Zale, MSU and Dick Oswald, FWP. $3,000 for student box watcher and equipment.

1.5.B.iii. *Validation and use of PCR for detection of infection in worms and fish:* Dr. Stu Knapp, MSU. Dr. Knapp is funded for the first 6 months, but needs additional support for the final 18 months. $54,000.

1.5.B.iv. *Expanded live box work, Madison River:* Beth MacConnell, Bozeman Fish Tech Center. $30,000 for field aquaria and labor.

1.5.B.v. *Review of genetic information available on wild and native species in Montana to assess genetic differences between strains. Evaluate what additional genetic testing may be necessary*: Cooperative Unit at University of Montana. Funding support amount unknown.

In addition to these specific research proposals, the Science Subcommittee has received suggestions for research in several other areas. These include studies of strain differences and the range of *M. cerebralis;* host resistance and immunity to infection; development of ELISA methods for measuring TAMs in stream water; infection and disease in Red Rock Creek and Red Rock Lake focusing on cutthroat and grayling; methods for collection and counting free-swimming TAMs in natural waters; and the relationship between whirling disease infection, body condition and survival of wild salmonids. The Task Force invites additional proposals from scientific researchers and organizations who have expertise in the areas discussed above. All proposals submitted to the Task Force should be submitted to the address listed below; they will undergo rigorous evaluation by impartial outside experts who can assist in prioritizing proposals and research needs.

It is apparent that government, university, foundation and individual contributions will be needed to fund this research effort. The research efforts identified in items 1.5.B above will require several hundred thousand dollars over the next two years, and other research needs are likely to raise that figure considerably higher. The Task Force will be working in the coming months to develop strategies to carry these research proposals to appropriate funding sources.

Finally, in the area of research, the Task Force wishes to emphasize the need for communication and networking with researchers and agencies in other states. Governor Racicot is encouraged to utilize his office to open all available lines of communication to other states to insure that whirling disease research is reasonably coordinated and that new scientific results are rapidly disseminated to all who could benefit from them.

Research proposals should be submitted to: Montana Whirling Disease Task Force, P.O. Box 6517, Helena, MT 59604

The Task Force's best hope is that research and technology will eventually identify a long-term "solution" to the whirling disease problem that achieves the goal of maintaining and restoring self-sustaining populations of wild salmonids. Pragmatically, a "quick fix" is unlikely and it probably will be a number of years before researchers can determine whether a long-term solution is achievable. In the meantime, fisheries managers must learn to manage wild trout populations with the presence of whirling disease.

Management Approach

The base of knowledge about whirling disease and how it affects wild trout populations is still fairly limited, although it is growing at a rapid rate. The next several years will be a learning period for everyone involved with whirling disease. One result of a limited understanding of whirling disease is that it will be more difficult to predict beforehand – at least with a high degree of certainty – the results of some management actions. There are likely to be some "surprises."

Recognizing that current knowledge is limited and that fisheries management strategies will evolve and respond to new information as it is acquired, the Task Force recommends that fisheries management in whirling disease-infected waters take the following approach:

> **Management Approach** – Fisheries management should emphasize learning so that incrementally more informed management decisions may be made as time passes.

Management should be treated as an opportunity to learn by doing. By formulating a management action as a hypothesis, taking actions that have an observable effect, and designing monitoring efforts at the outset to measure effects, management can become a means by which to gradually improve our knowledge and understanding of whirling disease.

Management Goals and Action Recommendations:

After reviewing and discussing management issues with a panel of fisheries managers, the Task Force identified several management goals. The intent is to provide guidance to Montana Fish, Wildlife and Parks on how to balance the dual objectives of maintaining recreational fishing opportunities over the short-term and restoring self-sustaining wild trout populations over the long-term, until research provides a longer-term "solution" to whirling disease. The Task Force recommends the following goals:

2.1. **Conserve populations of wild salmonids (both native and non-native species) that survive within whirling disease-infected waters.**

Some young-of-the-year rainbow trout in the Madison River have survived when 90% of their cohorts have perished in face of whirling disease. This may also be true of diseased populations of trout in other rivers. Why do some survive? At present, we do not know. However, if the reason is because of a genetic or behavioral trait in those particular fish, then it is critical that we maintain a viable population of them, for they may be the key to a long-term solution.

Conserving populations of wild salmonids that survive in whirling disease-infected waters may require special management considerations, such as an extra measure of habitat protection or special fishing regulations. The need for and appropriateness of these measures will vary from stream to stream and over time, and generally must be determined on a case-by-case basis.

Small populations are especially vulnerable to changes in environmental conditions. A normal population of healthy trout may suffer a population reduction as a result of low water flows, a change in water quality, loss of riparian habitat or some other environmental or habitat change, but the population is still likely to survive. However, such changes may severely impact a population already depleted by whirling disease. In some instances, it may be necessary for Fish, Wildlife and Parks and public and private land management agencies to take extra precautions to protect fish habitat.

In some circumstances, angling may also have a significant impact on small populations of whirling disease survivors. In a normal healthy fish population, the number of fish within a population that die each year as a result of angler harvest and stress or wounds from being caught generally falls within the expected natural mortality rate. That is, many of the fish in that population would have died of natural causes even

in the absence of angling. However, there is a potential for whirling disease to reduce a trout population to such a small percentage of its previous level that the impacts of angling become significant. In these instances, the Department and Commission of Fish, Wildlife and Parks should take whatever management actions are appropriate to conserve populations of wild salmonids that survive in whirling disease-infected waters.

The Task Force specifically recommends that FWP develop a proactive management plan, in which the Department sets forth the types of emergency measures which it would implement under different whirling disease scenarios, and the likely conditions under which it would do so. These emergency management options could include, but are not limited to, establishment of no-kill zones for different trout species, implementation of slot limits, increased use of catch-and-release requirements, and partial or full closure of bodies of water.

Proactive management would begin on those rivers with existing whirling disease infection. Criteria would be developed as to when emergency plans would be implemented on streams in each drainage. For example, the fish population on Willow Creek is believed to be the last pure genetic strain of DeSmet rainbow trout, and is currently suffering very high rates of whirling disease infection, emergency regulations should be developed with this fishery as an important test case. Proactive development of potential emergency management regulations relating to native grayling stocks on the Big Hole should also be given top priority.

Furthermore, the Task Force believes that a proactive emergency management plan should be fully communicated to the public, well in advance of the actual implementation of such a plan.

Action Recommendations:

2.1.A. When and where necessary to conserve populations of wild salmonids that survive in whirling disease-infected waters, the Department of Fish, Wildlife and Parks and public and private land management agencies should take extra precautions to protect fish habitat.

2.1.B. The Department and Commission of Fish, Wildlife and Parks should continue to monitor the impact of angling on populations of wild trout that survive in whirling disease-infected waters. Where appropriate, special management actions should be taken to conserve surviving populations.

2.2. Control the spread of whirling disease.

Across the nation, the primary vector responsible for the spread of whirling disease from one watershed to another is the transportation and introduction of infected live fish. There are several ways this happens. In other states, a number of federal, state and commercial fish hatcheries have planted infected fish in rivers before the presence of whirling disease was discovered in the hatchery. Infected fish may be planted in a private pond, and the disease then transmitted to a nearby stream via an outlet or via overflow during a flood. "Bucket biologists" — citizens who take fisheries management into their own hands by illegally planting fish into a lake or river — potentially may also contribute to the spread of the disease.

It is not clear how whirling disease spread to Montana. To date, we cannot with certainty prove how any of our waters became infected. The transportation of infected live fish is a logical culprit. In 1995 all of the federal, state and commercial fish hatcheries in the state tested negative for the presence of whirling disease. However, some commercial hatcheries in adjacent states have tested positive.

Other vectors being evaluated as potential mechanisms for the spread of whirling disease from one watershed to another include: fish-eating birds such as eagles and pelicans, fresh or frozen trout from grocery stores or restaurants (the spore can survive for months in frozen fish), mud on boats or waders, and bait fish. The relative contribution of these possible vectors to the spread of whirling disease in Montana remains unknown.

Once a river is infected, whirling disease can spread downstream through the natural movement of fish and spores in the water column. It may also be spread upstream, downstream or into tributaries as infected fish migrate either from rearing areas or to spawning areas.

Whirling disease is an exotic invader species not native to Montana. And like other exotic species, for example spotted knapweed, once established it becomes virtually impossible to completely prevent its continued spread. Thus, over the long-run, it is likely that whirling disease will spread to every major river basin in the state where both trout and the parasite's alternate host, *T. tubifex* worms, are found. The parasite may not be ubiquitous within every basin — some watersheds may have heavy infections while others do not — but we should assume it is likely to spread throughout the state despite our best efforts at control.

Nonetheless, management and regulatory actions designed to contain and slow the spread of whirling disease are of vital importance. By limiting the spread, we lessen impacts and provide additional time during which to develop a long-term solution. Many actions to control the spread of whirling disease may also have a side benefit of preventing the introduction of other exotic fish species, parasites and diseases.

A number of actions to control the spread of whirling disease have already been taken. These include:

- The adoption of legislation to better regulate private fish ponds and the transportation of live fish.
- The development of protocols to test state, federal and private hatcheries for the presence of whirling disease.
- The development of hatchery protocols to minimize the potential spread of whirling disease by state hatcheries, including protocols for egg collection, fish transportation, stocking and disease prevention.
- The development of protocols to prevent the inadvertent spread of whirling disease by field biologists, anglers, boaters and other water recreationists.
- A prohibition on the use of salmonid fish as cut bait.
- A prohibition on the use of sculpins (which may carry whirling disease) as bait.

In addition, Montana Fish, Wildlife and Parks is reviewing its permitting and regulatory program for private fish ponds in light of the whirling disease threat. Over 400 new private ponds have been licensed in the last two years.

Action Recommendations:

2.2.A. Unless demonstrated to be ineffective, existing management actions to control the spread of whirling disease should be continued. Management actions to control the spread of whirling disease should adapt as new information is gained about the vectors responsible for its spread.

2.2.B There is a strong likelihood that earth moving equipment which is used in and around waterways can become contaminated with whirling disease infected

mud. The Task Force recommends that all responsible regulatory agencies provide information to contractors concerning the need to clean their machinery and equipment on-site after completing a job in order to avoid inadvertently spreading the disease.

2.2.C. Additional emphasis should be placed on interagency cooperation to prevent the spread of whirling disease. FWP has solicited the cooperation of federal natural resource management agencies in addressing the whirling disease problem. Contacts have been made and agency involvement initiated. However, a number of major issues relating to the inadvertent spread of whirling disease remain unresolved. One foremost issue involves the sources of water that are used in fighting forest fires. Water removed from streams and lakes and transported to other areas to fight fires is a potential means for spreading the disease. Agency policies need to be formulated regarding this and other related issues.

2.2.D. The difficult and politically sensitive issue of fresh or frozen trout imported daily into Montana as food should be addressed. A single trout head may contain as many as 200,000 to 500,000 *Myxobolus* spores without obvious external evidence of deformities. We are advised by sanitary engineers that sewage treatment systems will not kill spores. Thus, a single fish head placed in a kitchen disposal presents a significant hazard if it is spore laden (this holds true, as well, for fish caught in infected waters, where the risk of spread of infection to another watershed is even higher). Idaho now produces most commercial fish. Some of the major facilities are thought to be free of whirling disease, but many smaller operations may not be clean, and there are no regulations at present, in Idaho, Montana or other states which ensure that whirling disease will not be further spread by this means. Montana FWP does not have clear authority to promulgate rules in this situation, nor the funds to test the large numbers of fish required to be sure that whirling disease spores are not being introduced in this way. The Task Force recommends that the Governor ask the FWP, Health and Commerce Departments to coordinate efforts on this potential problem.

2.3. **Minimize the impacts of whirling disease on recreational fishing opportunities, as consistent with goals 2.1 and 2. 2.**

The overall objective of Task Force recommendations is to protect, preserve and restore self-sustaining populations of wild salmonids. The objective is to provide the highest quality angling experience possible for the greatest number of people – to maintain the unequaled Blue Ribbon trout fishing to which Montanans and others are accustomed.

Whirling disease will likely result in reduced angling opportunities, including reduced catch rates, for recreational and commercially guided anglers – at least in some infected waters. Management should seek ways to minimize these impacts and to maintain recreational fishing opportunities, but not to the detriment of long-term objectives.

The Task Force discussed at length the option of stocking catchable trout as a means of enhancing recreational fishing opportunities in whirling disease-infected waters. At this time, the Task Force does not believe this is an appropriate management option. Montana FWP has extensive documentation of the negative impact of hatchery fish on wild trout, and the Task Force believes that the stocking of catchable trout conflicts with the overall goal of protecting, preserving and restoring self-sustaining populations of wild salmonids. At the same time, the Task Force recognized that under limited circumstances hatcheries may play a role in restoring wild trout populations, and that as a management tool, the future use of hatcheries should not be eliminated as an option.

Indeed, new demands on hatchery trout may soon appear in order to stock certain reservoir fisheries which, in recent years, have been partially or completely self-reproducing. Harrison, Clark Canyon, and Georgetown Lakes all have whirling disease-infected spawning tributaries, and Harrison seems to be in an advanced state of reproductive collapse.

3. Communication / Education / Outreach

Effective communication and education about Montana's unique wild and native trout resource and whirling disease is of critical importance, in the judgment of the Task Force. It is vitally important that the facts be presented – as we know them, when we know them. The public needs straightforward information on the status of whirling disease and ongoing research activities. To accomplish this, we recommend that Fish, Wildlife and Parks continue to serve as the primary conduit for such information, with assistance from the Task Force and its members.

The Communications Role of the Task Force

The Task Force believes that FWP is the appropriate agent for communicating much of the relevant information about whirling disease. This suggests that the optimal role of the Task Force with respect to information dissemination should be primarily of an advisory capacity, both serving as a sounding-board for FWP's communications efforts and lending public credibility to those efforts. In this type of advisory capacity, the Task Force would have ongoing input concerning the tone and content of communications which are disseminated by the Department.

Communications Messages

The Task Force believes it is important to pursue a public education program which includes a number of distinctly different long-term communication themes:

- Whirling disease *is* a serious problem
- The disease has caused population declines in some streams
- But the sky is not falling – many excellent fishing opportunities remain
- How the disease is spread
- What is at risk – our wild trout heritage
- What is currently being done
- What individuals can do to help – containment efforts
- Support of fundraising

Many long-term communication messages are not intended simply to convey information, but to do so in ways that encourage change in behavior. Increased compliance with recommendations for containing the disease, and increased likelihood that a group or individual will provide financial support for whirling disease research/education efforts are especially important behaviors which we hope to encourage over the long term.

3.1. FWP Activities

Action Recommendations:

3.1.A. The Department should continue its practice of releasing new information as it is obtained. The Department's credibility depends upon being perceived as an objective information source, and the Task Force believes that both information-gathering and information-dissemination are critically important FWP tasks.

3.1.B. The Department should continue its distribution of simple communication materials to inform the public about the presence of whirling disease and to provide "Do's and Don'ts" recommendations for containment. This should include distribution of pocket cards to individuals who purchase fishing licenses, whirling disease advisory signs at fishing access sites, and related activities.

3.1.C. FWP is planning to expand its efforts to educate the public about the value of wild and native trout. The Task Force believes this is an important adjunct to basic communications about whirling disease, underscoring what is at risk.

3.1.D. Expanded monitoring of the mass media to assess how the whirling disease problem in Montana is being characterized by out-of-state publications including the national news media, as well as sporting/fishing and travel publications.

3.1.E. Education is a key communications objective, and the Task Force unanimously recommends increased attention on high school and elementary school children as an important long-term audience. FWP plans to develop a whirling disease curriculum for distribution to schools, and the type of "science day" activities which recently were developed in the Bitterroot area can serve as a useful model. The Task Force should encourage and support educational efforts, particularly hands-on activities in which students and educators can participate.

3.1.F. Increased attention on internal communications to FWP and other agency employees is also recommended. Ongoing education of staff as to what is known (and not known) about the disease is needed.

3.1.G. Formal evaluation of communications activities is also strongly recommended. Survey research should be conducted to assess who is receiving messages about whirling disease, and the impact of those messages on their intended audiences.

3.1.H. Finally, the publication and distribution of research results by Montana Fish, Wildlife and Parks and other whirling disease investigators should be given high priority.

3.2. Task Force Activities

Members of the Whirling Disease Task Force can assist FWP in a variety of communications activities.

Action Recommendations:

3.2.A. Serving as a sounding board for new communications materials. Are the communications messages consistent with our overall understanding of the facts about whirling disease, as new field research and laboratory work is completed? Do communications materials strike an appropriate balance between communicating the seriousness of the issue and the fact that Montana fishing opportunities remain largely unparalleled in the U.S.?

3.2.B. The Task Force should monitor legislative activity at the state and federal levels and encourage support of the objectives of the Task Force.

3.2.C. Many Task Force members can be used as effective spokespersons for the state and national media. The Task Force includes eminent scientists, well-known sportsmen, and representatives from a number of well-known organizations. Task Force members can increase credibility of outreach to the media by talking as experts, by talking sportsmen-to-sportsmen, and so forth.

3.2.D. Some Task Force members have volunteered to assist in other outreach activities. Presentations to local civic organizations and sporting clubs, to

school groups, and other audiences are positive ways to inform the public about the whirling disease issue. A slide show similar to the one currently being used by some FWP employees, scripted for Task Force members and other volunteer presenters, should be developed.

3.2.E. The Task Force can play a central role in fundraising activities, seeking financial assistance from various private sector organizations and individuals, and through lobbying appropriate lawmakers and agencies. The Task Force believes that significantly increased funding for whirling disease efforts should be sought from the 1997 state legislature, and that all opportunities to increase federal funding should also be taken. In addition to financial support from government, the support of individuals and organization will be needed to achieve the fundraising goals which are set forth in this report, and the Task Force is well-positioned to assist in this regard.

3.2.F. The Task Force also believes it is important to increase communication with other whirling disease organizations, Trout Unlimited, and other national organizations with a direct interest in this issue. It is important to expand coordination and outreach activities, including increased contacts with other state, national and international groups working on whirling disease, sharing information on the recommendations and activities of the Task Force and seeking information on their goals, objectives and activities.

3.2.G. The Task Force should encourage appropriate sporting goods manufacturers and retailers to include information about native and wild trout and whirling disease in their catalogs and product packaging.

Next Steps

The Task Force has set forth a very ambitious set of recommendations to address the whirling disease problem. An active partnership between public agencies and private groups and individuals will be needed for their successful implementation.

In order to insure that a viable public-private partnership is in place to carry out these recommendations, Governor Racicot has issued an Executive Order which extends the Task Force to October 1, 1996 (See Appendix 2). In the coming months, the Task Force will work to define the roles and responsibilities of the various members of the public-private partnership which is being built to implement the Task Force's recommendations. The Task Force will develop more detailed costs estimates of the research and communications activities recommended in this report , along with the financial commitments that must be made by various public and private partners to achieve these recommendations. Our objective is to insure that the immediate needs are met, while the capacity to meet longer term needs is developed. The Task Force will also evaluate the need for and feasibility of establishing a council or other advisory committee to oversee implementation of Task Force recommendations upon termination of the Governor's Executive Order.

There are many skills and talents which can be brought to bear on whirling disease – both within and outside the state – and the Task Force hopes to find an institutional arrangement which can insure that those resources are brought to be on the problem in a timely and effective manner.

Conclusion

This report began by noting that a remarkable amount of work has already been done on the whirling disease problem. Montana Fish, Wildlife and Parks has led the way and has committed substantial resources. Private individuals and groups such as Trout Unlimited and the Whirling Disease Foundation have also generously committed time and expertise to this problem. The wide-ranging recommendations of this report, however, make it apparent that the financial and human resources which are available to address the whirling disease problem are simply inadequate for the many tasks which lie ahead.

To summarize the cornerstones of our recommendations:

Research:

We recommend an aggressive research program to facilitate the diagnosis and control of whirling disease, and to identify strains of wild and native trout that exhibit resistance to the disease. Research activities should follow parallel tracks – pursuing immediate research needs and longer-term construction and operation of a wild trout research facility in Montana.

Management:

We recommend management decisions and policies that will nurture survivors and maintain native and wild trout populations, while recognizing the need to preserve our unexcelled recreational fisheries.

Education:

Management and research will prove useless if education is inadequate. Therefore, we recommend an ongoing communications effort to ensure that all Montanans fully understand the value of our wild trout fisheries . . . and how to help protect them.

The Task Force has begun the process of forging a strong public-private partnership to accomplish these vitally important needs, and will continue that process in the coming months. It is very possible that our state's wild trout heritage hangs in the balance.

Appendices

Appendix 1
Task Force Executive Order

State of Montana
Office of the Governor

Executive Order No. 3-95

EXECUTIVE ORDER CREATING THE GOVERNOR'S
WHIRLING DISEASE TASK FORCE

WHEREAS, whirling disease has been discovered in a number of Montana's wild trout streams; and

WHEREAS, this salmonid disease may have influenced a dramatic decline in the upper Madison River's wild rainbow trout population; and

WHEREAS, Montana manages its trout streams for wild trout and does virtually no stocking of its rivers and streams with hatchery trout; and

WHEREAS, whirling disease could impact Montana's wild trout fishery more than other hatchery-dependent states; and

WHEREAS, most scientific research on whirling disease has focused on fish hatcheries and hatchery-reared trout; and

WHEREAS, the manner in which whirling disease functions in wild environments is not well understood; and

WHEREAS, whirling disease could also pose a threat to Arctic grayling and bull trout, two native species already the

focus of state special management plans; and

WHEREAS, the net economic value of trout fishing in Montana is more than $270 million annually; and

WHEREAS, Montana's current wild trout management philosophy provides for more than 1.3 million fishing days for Montanans and its visitors; and

WHEREAS, Montana's trout streams serve as an international attraction and the whirling disease issue is of such a concern that there is a need to build New Partnerships among public and private interests; and

WHEREAS, there is an opportunity for the people of Montana to benefit from a vast national pool of scientific expertise.

NOW, THEREFORE, I, MARC RACICOT, Governor of the State of Montana, by virtue of the authority vested in me by 2-15-122, MCA, do hereby create the Governor's Whirling Disease Task Force.

I. PURPOSE

A. The Whirling Disease Task Force shall:

1. create a public-private partnership to examine and identify issues relating to whirling disease in Montana;

2. develop an action plan to address the whirling disease problem. The action plan shall encompass short- and long-term recommendations and focus on: (a) scientific research, (b) communication and education, (c) fisheries management and policy, (d) economic and

social impacts, (e) additional coalition building to assist the Task Force and (f) establish a fund-raising procedure to support recommended research;

3. publish its recommended action plan in two phases. Phase I should focus on short-term recommendations, and Phase II should address long-term solutions.

B. The Whirling Task Force shall appoint technical committees comprised of technical and scientific specialists to assist the Task Force in making informed recommendations.

II. COMPOSITION

The Whirling Disease Task Force shall be composed of not more than 20 members. The names and addresses of members who shall serve at the pleasure of the Governor shall be submitted by separate letter to the Department of Fish, Wildlife and Parks and the Secretary of State.

III. DURATION

This Task Force shall remain in existence until January 1, 1996, unless extended or terminated by subsequent Executive Order. This Order is effective immediately.

GIVEN under my hand and the GREAT SEAL of the State of Montana, this 22nd day of May, 1995.

Marc Racicot

MARC RACICOT, Governor

ATTEST:

Mike Cooney

MIKE COONEY, Secretary of State

Appendix 2
Executive Order Continuing the Task Force

State of Montana
Office of the Governor

Executive Order No. 14-95

EXECUTIVE ORDER CONTINUING THE
WHIRLING DISEASE TASK FORCE

WHEREAS, Montana's wild and native trout fisheries constitute a priceless component of Montana's natural heritage and a significant component of the state's economic foundation; and

WHEREAS, whirling disease, a parasitic disease of salmonids caused by *Myxobolus cerebralis*, presents the single greatest threat to the long-term survival of Montana's wild and native trout; and

WHEREAS, whirling disease has now been found in 16 trout waters in Montana; and

WHEREAS, whirling disease is likely, over time, to spread to every river drainage in Montana where both wild trout and *Tubificid* worms, the parasite's intermediate host, are found; and

WHEREAS, while significant progress has been made over the last year, there is still much learn about whirling

disease, its impacts on wild trout, and how to manage in its presence; and

WHEREAS, the Whirling Disease Task Force has successfully established a public-private partnership; and

WHEREAS, a public-private partnership is critical to the successful implementation of the Task Force's long-term recommendations; and

WHEREAS, by the actions of the Whirling Disease Task Force, the State of Montana is establishing a model with which other states can attack the whirling disease problem.

NOW, THEREFORE, I, MARC RACICOT, Governor of the State of Montana, by virtue of the authority vested in me by 2-15-122, MCA, do hereby continue the Governor's Whirling Disease Task Force.

I. PURPOSE

The Whirling Disease Task Force shall:

A. Define the roles and responsibilities of the various members of the public-private partnership in implementing the Task Force's recommendations;

B. Recommend the financial commitments that must be made by private and public partners to achieve the Task Force's recommendations, ensuring that needs for the next few years are met while the capacity to meet longer term needs is being developed;

C. Evaluate whether an organization currently exists or a new organization is needed to bring private financial

and other resources into the partnership; and

D. Evaluate the need for and feasibility of establishing a council, advisory committee or other body to oversee implementation of Task Force's recommendations upon termination of this Executive Order.

II. COMPOSITION

The Whirling Disease Task Force shall be composed of not more than 25 members. The names and addresses of members who shall serve at the pleasure of the Governor are submitted by separate letter to the Secretary of State.

The Whirling Disease Task Force may recommend additional members to the Governor if necessary to accomplish the purposes of this Executive Order,

III. DURATION

This Task Force shall remain in existence until October 1, 1996, unless extended or terminated by subsequent Executive Order. This Order is effective immediately.

GIVEN under my hand and the GREAT SEAL of the State of Montana, this 20th day of December 1995.

Marc Racicot

MARC RACICOT, Governor

ATTEST:

Mike Cooney

MIKE COONEY, Secretary of State

Appendix 3
Roster of Task Force Members

Patrick Graham, Co-chair

Director, Department of Fish, Wildlife & Parks. Fisheries biologist. Helena, MT.

Marshall Bloom, M.D., Co-chair

Research Medical Officer, Rocky Mountain Lab, U.S. Public Health Service. Montana Trout Unlimited State Council member (former chairman), National TU Regional Vice President. Hamilton, MT.

Jim Ahrens

President of the MT Hospital Association. Active in state and national programs. Currently a member of various health-related boards and committees. Helena, MT.

Kirby Alton, Ph.D.

Senior Vice President for Product Development, AMGEN. Ph.D. Molecular geneticist with AMGEN, a biotechnology company involved in medicine. Owner of a ranch on the Madison River. Thousand Oaks, CA. Local Address: Ennis, MT.

Tom Anacker

Attorney. Member of TU and serving as Madison-Gallatin Chapter VP and on MT State Council. Member of Madison Coalition. Founding member of Whirling Disease Foundation. Bozeman, MT.

John Bailey

Owner of Bailey's Fly Shop. Livingston, MT.

Matt Cohn

Director, Travel Montana. Montana Department of Commerce. Helena, MT.

Robin Cunningham

Executive Director of Fishing Outfitters Association of Montana (FOAM). Licensed fishing outfitter for Headwaters Guide Service. On the Montana Board of Outfitters. Gallatin Gateway, MT.

Mike Hayden

President/CEO of American Sports Fishing Association. Former Governor of Kansas, former Assistant Secretary of the Interior for Fish, Wildlife and Parks. Alexandria, VA.

Roger Herman, Ph.D.

Director of the National Fish Health Research Laboratory. Fish pathologist. Held faculty position with various universities since 1959. Kearneysville, WV.

Karl M. Johnson, M. D.

Member, Madison Coalition. Whirling Disease Foundation founding member. Former Chief, Special Pathogens Branch, Virology Division, Centers for Disease Control and Prevention, Atlanta, Georgia. Bozeman, MT.

Hanta Virus
Ebola Virus

Bob LeFever

Owner, Fran Johnson's Sport Shop. Butte, MT.

Bud Lilly

Owner, Bud Lilly's Angler Inn. Member of MT Ambassadors. Past National Director for TU; Board Member of MT River Action Network; Served on Greater Yellowstone Coalition Board. Bozeman, MT.

Dud Lutton

Development Director of the Montana Nature Conservancy. Helena, MT.

Roger Nelson PVT AQUACULTURE

Owner, Nelson's Spring Creek Ranch, Livingston, MT.

Art Neill

Executive Vice President and Director of Montana Power Company. Responsible for MPC hydro power systems and relicensing. Butte, MT.

Chris Somers

Attorney in private practice. Founding board member of Big Hole River Foundation. Interest in The Complete Flyfisher, Wise River. Butte, MT.

Marsha L. (Josh) Turner

Owner, Turner and Associates, a consulting firm specializing in management, public relations, and public policy consulting. Treasurer, Montana Wildlife Federation. Helena, MT.

Bruce Whittenberg

Publisher, Helena Independent Record, since 1993. With Lee Enterprises for 15 years. Helena, MT.

Ed Williams

Owner, Rainbow Valley Motel; President Ennis Chamber of Commerce; President Elect Ennis Lions' Club. Ennis, MT.

Science Subcommittee

The following scientists and fisheries professionals have participated several meetings of the Task Force and serve its Science Subcommittee:

Karl Johnson, M. D. (co-chair)	Whirling Disease Foundation
Dick Vincent (co-chair)	FWP Fisheries Manager
Tom Anacker (Exec. Comm. Liaison)	Whirling Disease Foundation
Rick Barrows, Ph.D.	USFWS, Bozeman Fish Technology Center
Scott Earley	SGM Biotech, Inc., Bozeman
William Granath, Ph.D.	University of Montana
Dan Gustafson, Ph.D.	Montana State University
Wayne Hadley	FWP Fish Biologist
Cal Kaya, Ph.D.	Montana State University
Stu Knapp, Ph.D.	Montana State University
Tom McMahon, Ph.D.	Montana State University
Beth MacConnell	USFWS, Bozeman Fish Technology Center
John Nickum, Ph.D.	USFWS, Bozeman Fish Technology Center
Dick Oswald	FWP Fish Biologist
Larry Peterman	Administrator, Fisheries Division, FWP
Jim Peterson	FWP Fish Pathologist
Earnest Vyse, Ph.D.	Montana State University
Bob White, Ph.D.	Unit Leader, Cooperative Fisheries Research Unit
Dennis Workman	FWP Region 2 Manager
Al Zale, Ph.D.	Assist. Unit Leader, Coop. Fisheries Research Unit

Appendix 4
Summary of Recommendations and Their Status

Recommendation	Who is Responsible	Est. Cost	Funds Available	Completion date
SCIENCE	SCIENCE	SCIENCE	SCIENCE	SCIENCE
1. Field monitoring looking for infected fish; documenting population declines known infected areas	FWP	Cost estimates being developed	Some funding is available, but no FTE	Spring, '96
2. Evaluate susceptibility of different species through live box testing	(A) USFWS - Fish Tech Lab (B) FWP - Reg. 3	(A) Unknown (B) $4,000	(A) n/a (B) $1,800 FWP $2,200 Gall. Chpt, TU	(A) Oct. 31, '95 (B) Oct. 31, '95
3. Research on WD sensitivity to water/waste treatment protocols	FWP - Glen Phillips DHES - ?	n/a	n/a	Aug., '95
4. Develop database on WD	WD Foundation	$6,000		
5. Expedite PCR	Dr. Stuart Knapp (MSU) Dr. Beth McConnell (USFWS)	$5,000 for feasibility analysis	none	June, '95 for initial assessment
6. Assessment of worm habitats in different watersheds	Dr. Cal Caya (MSU) Fred Nelson (FWP)	?	Up to $30,000 initial report	Spring, '96
7. Role of birds as vectors	Dr. Rick Barrows (USFWS)	None	n/a	Fall, '95

Recommendation	Who is Responsible	Est. Cost	Funds Available	Completion date
8. Archiving samples for future analysis from infected and noninfected areas	Jim Peterson (FWP)	$10,000	None	Ongoing - if funding becomes available
9. Cryo-preserving sperm samples	Deferred	n/a	n/a	n/a
10. Feasibility of in-state research lab	FWP, USFWS & MSU	Unknown	Unknown	Unknown
MANAGEMENT	MANAGEMENT	MANAGEMENT	MANAGEMENT	MANAGEMENT
11. Finalize hatchery protocols	FWP	n/a	n/a	Aug., '95
12. Coordinate state, federal, tribal & private entities for testing, field season actions, etc.				
13. Systematic examination of stocking practices	FWP	None	n/a	Fall, '95
14. Establish protocols for testing private ponds, actions for infected ponds	FWP	Depends on utilization	Initial funding by FWP	July, '95

Recommendation	Who is Responsible	Est. Cost	Funds Available	Completion date
COMMUNICATION	COMMUNICATION	COMMUNICAT'N	COMMUNICATION	COMMUNICATION
15. Release info as available	FWP - Conservation Education division	Cost unknown	Funds w/in existing FWP budget	Ongoing
16. Communicate that WD is the cause but the sky isn't falling	FWP & Comm'n Subcommittee			
17. DOs and DON'Ts	FWP - Conservation Education division	Cost unknown	Funds w/in existing FWP budget	Ongoing
18. Pond advisory	FWP - Conservation Education division	Cost unknown	Funds w/in existing FWP budget	Ongoing
19. Full inventory of resources for summer communications campaign	FWP & Comm'ns Subcommittee			

Recommendation	Who is Responsible	Est. Cost	Funds Available	Completion date
SOCIAL/ECONOMIC	SOCIAL/ECONOMIC	SOC/ECONOMIC	SOCIAL/ECONOMIC	SOCIAL/ECONOMIC
20. Madison creel census	FWP	$33,000	$33,000	Sept. 30, '95
21. Study economic impact on guides and fishing pressure changes				
22. Study economic impact on bed tax collections, tourism, etc.				

Appendix 5
Cost Estimates for River Stocking in Montana

The following provides an estimate of the cost of stocking the Madison River with rainbow trout to achieve pre-whirling disease levels of approximately 2,500 fish per mile.

ASSUMPTIONS:

1. Stocking in the upper Madison River, length of 55 miles, to maintain rainbow trout populations of 2,500 fish per mile.

2. To have 2,500 fish in the Fall, it is necessary to plant 7,500 fish in the Spring (expected summer mortality equals 66%). The fish plants would be yearlings (about 7 inches), not catchables.

3. The cheapest fish from a Montana State hatchery (and our hatchery costs are low when compared to other states) would come from the Big Spring Creek hatchery in Lewistown. Cost: 24¢ per yearling fish.

CALCULATION: 55 miles of river x 7,500 fish per mile = 412,500 fish. 412,500 fish x $.24 per fish = $99,000 ANNUALLY in order to provide recruitment equivalent to natural reproduction.

NOTES: The fish cost includes FWP's direct costs of raising the fish and the cost of doing a traditional plant (many fish in one place). Costs would increase if fish were to be evenly dispersed throughout the 55 miles of river. Also, the hatchery costs do not include the cost of obtaining eggs or capital costs for the hatchery. Overall, this is probably an underestimate.

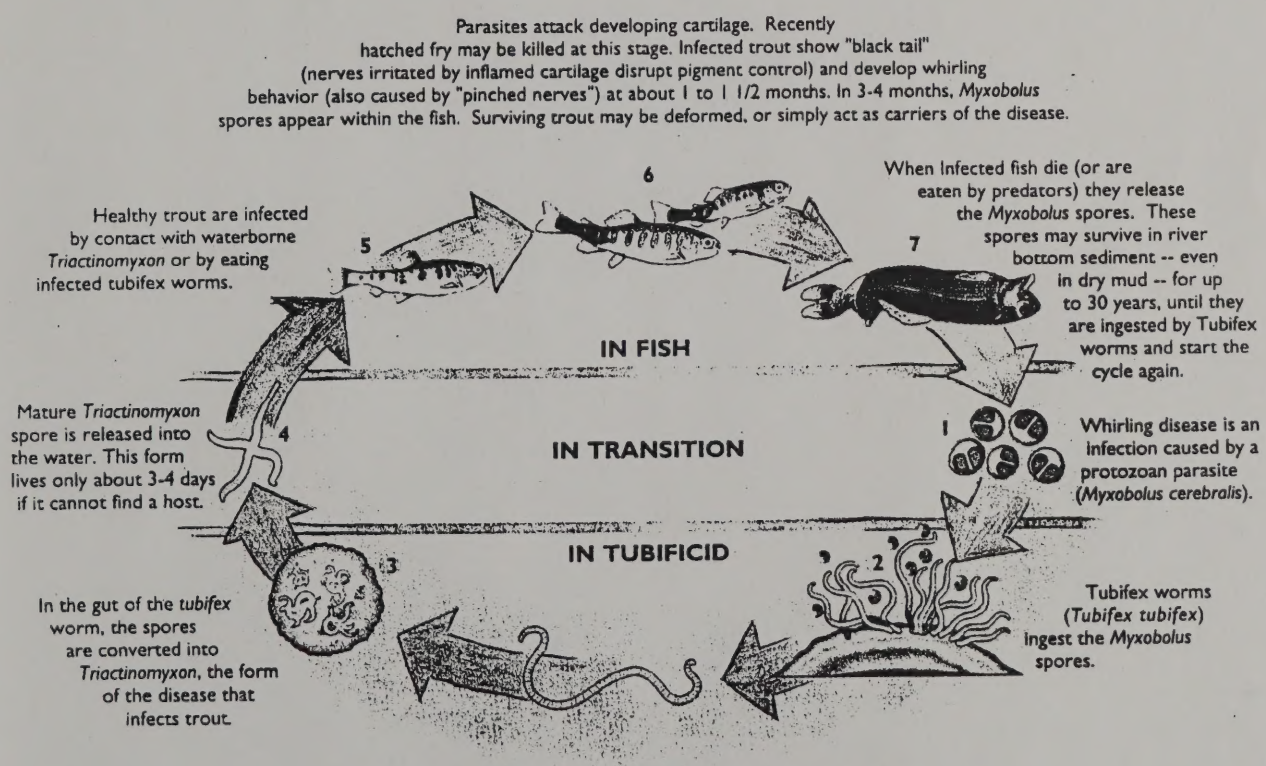
This also assumes that we have the additional hatchery capacity necessary to plant this many fish. Montana DOES NOT have the capacity to produce this many fish without taking fish that otherwise would have been planted elsewhere.

Appendix 6
Life Cycle of Whirling Disease

Whirling disease is caused by a microscopic, waterborne parasite that attacks the cartilage of young trout. Whirling disease spores (*Myxobolus cerebralis*) are released into the water when infected fish die and decompose, or when they are consumed and excreted by predators or scavengers.

As the chart below illustrates, the parasite has a complex, two-host life cycle that involves the trout and the bottom-dwelling *T. tubifex* worm, which is found in streams, rivers and lakes throughout Montana.

While the parasite may not directly kill a trout, an infected fish's erratic tail chasing makes it extremely vulnerable to predation. The disease also makes feeding difficult for infected fish, which can eventually result in starvation and death.



The Life Cycle of Whirling Disease

(Illustration borrowed from *Trout* magazine, Spring 1995)

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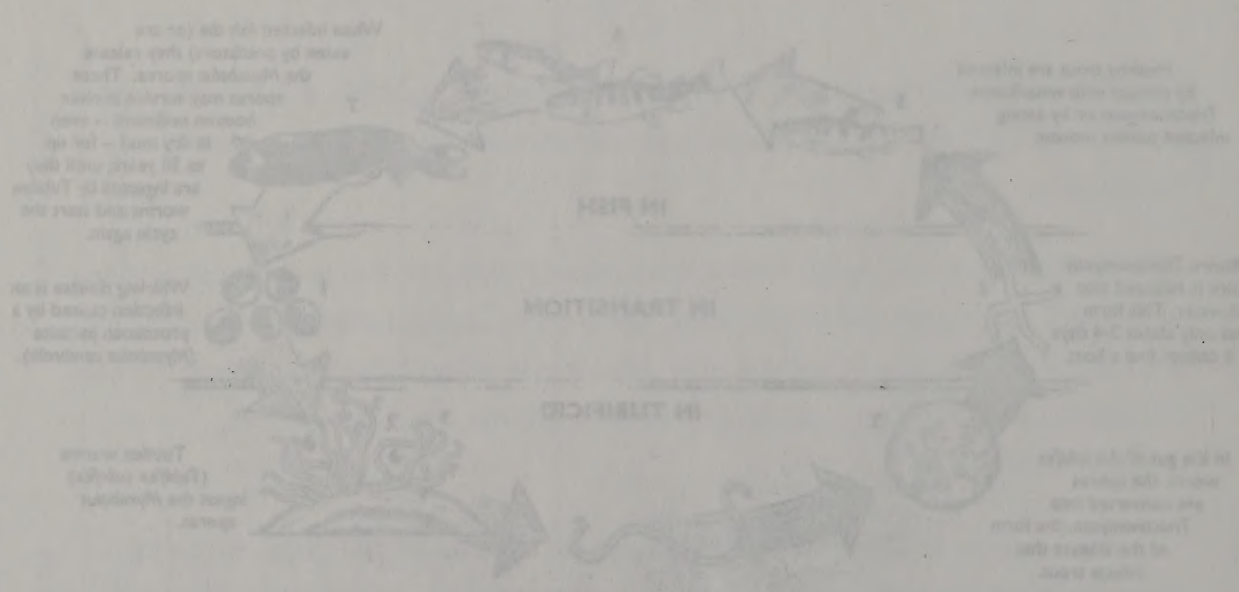

The Life Cycle of Whirling Disease

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